

University of Groningen

Triadic closure in core networks: Disentangling the effects of social distance, national origin similarity and shared contexts

Mollenhorst, Gerald; van Duijn, Maria; Rydgren, Jens; Edling, Christopher

Published in:
International Review of Social Research

DOI:
[10.1515/irsr-2016-0018](https://doi.org/10.1515/irsr-2016-0018)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2016

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Mollenhorst, G., van Duijn, M., Rydgren, J., & Edling, C. (2016). Triadic closure in core networks: Disentangling the effects of social distance, national origin similarity and shared contexts. *International Review of Social Research*, 6(4), [2]. <https://doi.org/10.1515/irsr-2016-0018>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

Research Article

Open Access

Gerald Mollenhorst*, Marijtje van Duijn, Jens Rydgren, Christofer Edling

Triadic Closure in Core Networks: Disentangling the Effects of Social Distance, National Origin Similarity and Shared Contexts

DOI 10.1515/irsr-2016-0018

Received: April 24, 2016; Accepted: May 8, 2016

Abstract: Acknowledging that the composition and structure of personal networks is affected by meeting opportunities, social distance, and national origin similarity, we aim to disentangle their association with triadic closure in the core of personal networks. We use data (collected 2009) on the core networks of three groups of Swedes (all born in 1990): native Swedes, and first- and second-generation immigrants from Iran and former Yugoslavia, where the respondent (ego) mentions up to five core network members (alters) and whether each pair of alters (dyad) know each other (triadic closure). A three-level multiple membership logistic regression model is performed, which allows the testing of dyadic alter-alter effects, ego effects, and their interaction (i.e., ‘triadic’ effects) on triadic closure. We show that social distance, national origin similarity, and the sharing of social contexts are all associated with triadic closure in the expected direction, and that the effects of social distance and national origin similarity become smaller if shared social contexts are taken into account. The effects of the sharing of social contexts are the largest and are robust, indicating that shared social contexts are a dominant and more important condition for triadic closure than are similarity on relevant socio-demographic characteristics.

Keywords: triadic closure, personal relationships, core networks, social contexts, meeting opportunities, similarity, social distance, national origin

Introduction

Previous research has recurrently revealed that sociodemographic similarity and meeting opportunities both positively affect the emergence of personal relationships. According to the *homophily principle*, people tend to associate with others who are like themselves (e.g., Lazarsfeld and Merton 1954, McPherson et al 2001). In other words, the smaller the social distance between two people such as in terms of age, sex, level of education, or occupational status, the more likely they will relate with each other (cf. Blau and Schwartz 1984: 9).

This tendency has often been explained in terms of preferences for similar others over dissimilar others, because similar others may have more in common (e.g., Byrne 1971). Various sociologists have argued and have shown that personal relationships emerge and continue as a consequence of meeting opportunities (e.g., Simmel [1922] 1955, Blau 1977, 1994, Fischer et al 1977, Feld 1981, Fischer 1982, Marsden 1990, Mollenhorst et al. 2008a, 2014). The number and types of network members are affected by the social composition as well as other structural characteristics of the social contexts in which people are embedded such as their family, neighborhood, work place, and the places where they spend their leisure time. Moreover, given that the social composition of many social contexts is disproportionately homogeneous in terms of age, sex, or education, this provides an additional explanation for why the composition of personal networks is generally disproportionately homogeneous in terms of sociodemographic characteristics (Marsden 1990, Mollenhorst et al. 2008b).

These arguments also apply to the broader structure of personal networks. Research by Mollenhorst and colleagues (2011) has revealed that triadic closure – that two of one’s network members also know each other – is affected by social distance as well as meeting opportunities. They showed that triadic closure is more likely if two of one’s network members (also referred to

*Corresponding author: Gerald Mollenhorst, Utrecht University, Department of Human Geography and Spatial Planning, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands. Telephone: +31302532041, Email: g.w.mollenhorst@uu.nl.

Gerald Mollenhorst, Jens Rydgren, Department of Sociology, Stockholm University, Sweden

Marijtje van Duijn, Department of Sociology/ICS, University of Groningen, the Netherlands

Christofer Edling, Department of Sociology, Lund University, Sweden

as ‘alters’) are similar in terms of level of education and/or religious background, and more importantly, that the sharing of the same social context(s) with both alters strongly and positively affects triadic closure.¹

In fact, because testing these structural explanations for network composition on network triads overcomes problems of many previous studies on ego-centered personal networks, we employ this strategy also in the current study on triadic closure in core networks. Studying triads, that is, studying the existence of alter-alter connections in ego-centered networks, namely provides a unique opportunity to assess the different conditions that are proposed to affect the formation of personal relationships. A shortcoming of most previous research on ego-centered personal networks is that it has examined only ego-alter relationships. Consequently, these studies lack information about the absence of relationships between people who could be related (e.g., because they share a specific social context, or because they have a friend in common). Research based on complete network data does include information about existing as well as non-existing relationships, but a shortcoming of these studies is that they focus on one specific social context (e.g., schools or neighborhoods). Our examination of triadic closure in ego-centered personal networks overcomes some of these problems (through the shared focal actor) and therefore seems to provide a better test of the proposed structural explanation for relationship formation and network composition.

In this paper we build and improve upon the aforementioned research by Mollenhorst and colleagues (2011) in three ways. First, we replicate the analyses of the effects of social distance and meeting opportunities on triadic closure, using a Swedish dataset on core networks. Second, we extend this research by adding the focus on national origin similarity in network triads. Third, we estimate three-level multiple membership logistic regression models, with occurrence of triadic closure defined as dichotomous dyadic outcome (alter-alter tie) belonging to two, equally important, alters, who are in turn nested hierarchically within egos. This model formulation is different from the usual multilevel model for the analysis of personal networks, with outcomes pertaining to alters, or ego-alter ties where alters are nested in egos.

National origin – which partly coincides with ethnic similarity – may indeed be seen as an additional social characteristic (next to age, sex, education, and religion), on the basis of which we may expect similarity in closed network triads. However, from the literature we know that, as compared to other sociodemographic characteristics, nationality and/or ethnicity is especially important, given that close interethnic relationships lead to the social, cultural, and economic integration of ethnic minorities (Espinosa and Massey 1997; Chiswick and Miller 2001; Kanas and Van Tubergen 2009) and decrease distrust between, prejudice towards, and discrimination against ethnic groups (Allport 1954; Pettigrew 1986, 1998). As described in the next section, national origin similarity in closed network triads can be a result of homogeneously composed social contexts in which network members are met and relationships emerge, although similarity in terms of sociodemographic dimensions other than national origin or shared social contexts may also result in closed network triads consisting of people with a dissimilar national origin (Blau 1977).

In short, we address two research questions:

- *What is the association between similarity on national origin and other social dimensions and triadic closure?*
- *Do shared social contexts have a consequence for the association between similarity on national origin and other social dimensions and triadic closure?*

To answer these questions, we use a dataset on core networks among 19-year-olds in Sweden. One of the great advantages of this dataset for this study is that because of oversampling, the number of first and second generation immigrants in the sample is relatively large. Many previous studies on ego-centered networks are based on a random sample, representative for the population of a country, and consequently lacked enough data on relationships between people with a dissimilar national origin (e.g., Mollenhorst et al. 2011). As will be discussed in more detail in the methods section, our sample consists of three different groups of Swedes all of whom were born in the year 1990: 632 individuals with at least one parent born in Iran; 928 individuals with at least one parent born in former Yugoslavia; and 1382 individuals whose parents were both born in Sweden. In addition, for all network members, we asked for their country of origin. As a consequence, we are able to study the effects of national origin similarity on triadic closure, thereby also looking at differences between native Swedes and immigrants.

¹ Research on triadic closure – also often called transitivity - has a long history; See for example, Heider (1958: 206), Holland and Leinhardt (1970), or Wasserman and Faust (1994:243-247). A measure similar to the one we use in this study of triadic closure was previously applied in, e.g., Krackhardt and Kilduff 1999, and Louch 2000, which they called ‘transitivity’.

Theory

Social distance

In the social psychological literature, the emergence of personal relationships is generally explained in terms of social distance between two individuals. Also, according to Blau and Schwartz (1984; cf. Simmel [1922] 1955), people use each other's social position as a criterion for interaction: the smaller the differences between two persons on various sociodemographic dimensions, the more likely they will be to associate with each other (cf. Blau and Schwartz 1984: 9). This tendency of people to associate with others who are like themselves is also referred to as the *homophily principle* (see Lazarsfeld and Merton 1954; McPherson et al. 2001, Louch 2000) and has often been explained from a demand-side perspective on personal relationships, arguing that people prefer similar others over dissimilar others because they feel they may have more in common (e.g., Byrne 1971). As a consequence, two alters will be more likely to know each other (and get along) the more similar they are on sociodemographic dimensions. Using this argument to explain closure in personal networks, we hypothesize that the probability of triadic closure in personal networks increases when the social distance between two alters decreases (H1).

National origin similarity

To improve upon previous research on triadic closure in personal networks (e.g., Mollenhorst et al. 2011), we pay specific attention to the effects of national origin similarity among alters. Consistent with other indicators of sociodemographic similarity, national origin similarity in personal relationships may be a result of personal preferences. Social psychologists studying personal attraction have generally addressed preferences for cultural similarity (e.g., Byrne 1971). Persons with the same national origin and cultural background are likely to share the same values and opinions. Similarity in terms of values and opinions leads to confirmation of each other's behavior and worldviews, similarity in terms of taste is attractive because it enlarges opportunities to participate in joint activities (cf. Feld 1981), and similarity in terms of knowledge creates a common basis for conversation, which enhances mutual understanding (Kalmijn 1998). Consequently, because cultural similarity leads to personal attraction, it increases the probability of getting involved with someone. Moreover, according to social identity theory (Tajfel and Turner 1979), there is a tendency toward

intra-ethnic relationships, because people have a need for a positive sense of self-worth, which is substantially influenced and defined by group membership. In short, we hypothesize that triadic closure is more likely if two alters have the same national origin (H2).

Social Contexts

A more sociological explanation for the emergence and continuation of personal relationships lies in the sharing of social contexts. People who share a social context or focus of activity are more likely to associate with each other than those who do not share any social context (Feld 1981). The social contexts that people enter into in their daily life such as the place where they work, the family they belong to, the neighborhood in which they live, the voluntary associations they are a member of, and so forth, provide the pool of available others out of which personal network members are selected (Fischer et al. 1977, Verbrugge 1977, Feld 1981). As a consequence, the number and types of network members are affected by the social composition as well as other structural characteristics of the social contexts in which people are embedded. The stability of personal relationships will likewise be stimulated if network members continue meeting each other in a specific context (Mollenhorst et al. 2014).

Being related in various contexts affects the structure and other characteristics of one's personal network (Simmel [1922] 1955, Feld 1981, Blau and Schwartz 1984), including triadic closure: "two individuals who are both tied to a third may share a focus with the third; and if they share the same focus with the third person, then they share that with each other and are likely to be tied to each other" (Feld 1981: 1022). We therefore hypothesize that triadic closure is more likely if two alters meet in the same social context (H3). Of course, the stimulating effect of social contexts on triadic closure varies by type of context (cf. Jackson et al. 1977: 45, Louch 2000). For example, when interactions with others in a certain social context are enforced, and when people spend much time in that context, it will be likely that relationships emerge among people in that context. Feld put it this way: "the more constraining are the foci that they share with the person, and consequently with each other, the more likely it is that they will be tied with each other" (Feld 1981: 1022; see also Feld 1982, Fischer 1982, Mollenhorst et al. 2008a). We discuss differential context effects on triadic closure in the results section in light of these general context characteristics.

Furthermore, applying Feld's proposition that more shared foci increase the likelihood of a relationship

between alters (Feld 1981), we hypothesize that triadic closure is more likely, the larger the number of social contexts one shares with both alters (H4). We note, however, that not all contexts can be easily combined in one relationship. As Simmel ([1922] 1955: 146) postulated it generally, “an overlapping of group-affiliations cannot occur if the social groups involved are too far apart with regard to their purpose and in terms of the demands they make upon the individual. And a group which wants its members to become absorbed unconditionally in its activities must regard it as incompatible with this principle if an individual is differentiated from other members by virtue of his simultaneous affiliation with another group.” In other words, the more similar the activities are that take place in two contexts, and the more similar the norms are that prevail in two contexts, the more compatible these contexts will be.

Another aspect we consider in this paper is the difference between what we call a *previously shared context* (which is related to Feld’s term *preexisting context* (Feld 1981: 1022–1023)), and what we call a *currently shared context*. When a person shared a specific social context with two of his/her alters – such that they have a previously shared context – triadic closure is more likely to occur than if they had not shared any context. It is possible, however, that each of these alters did not share this social context at the same time. In addition, if these alters no longer share this context, it may be the case that they also no longer see and consequently do not really know each other anymore.² Compared to previously shared contexts, when a person currently shares a specific social context with two of his/her alters, it is more likely that this person shares this social context with each of these alters at the same time. We therefore hypothesize that the effect of currently shared contexts on triadic closure is larger than for previously shared social contexts (H5).

We note that a *currently shared context* could be both a) the result of entering a social context in which one meets both alters without the intention of letting these alters meet each other, or b) the result of introducing one of these alters to this specific context with the intention to have him/her meet the other alter. If someone draws associates from multiple social contexts, his/her relationships may be with persons who do not know each other. This person may try to change this situation by finding or creating a context in which all network members can be met

simultaneously. Such creative network manipulations are most advantageous for those whose relationships involve a large amount of time, effort, and emotion, and if these relationships are based on compatible contexts. By finding or creating a context in which alters can be met simultaneously, people create closed triads over and above the triadic closure created by shared initial contexts (cf. Feld 1981: 1022–1023).

Synthesis: social distance, national origin similarity, and social contexts

In this research we use arguments similar to those in Mollenhorst et al (2011), which also implies that we employ a choice-constraint approach (Fischer et al. 1977) and examine the extent to which sociodemographic similarity, but in particular national origin similarity in personal relationships, are associated with shared social contexts (cf. Rydgren and Sofi 2011). As discussed in section 2.2, social contexts have an independent effect on relationship formation and stability, but it has been repeatedly shown that social-distance effects are also associated with the effects of shared contexts. People’s tendency to associate with others who are like themselves is not a simple result of a preference for similar others, but also a consequence of meeting in social contexts that bring together groups of people who are disproportionately homogeneous along some sociodemographic dimension (e.g., Marsden 1990a, Kalmijn and Flap 2001, Mollenhorst et al. 2008a, 2008b). Therefore, following a choice-constraint approach (Fischer et al. 1977), we argue that the social contexts in which people are embedded provide the pool of potential network members, but also that the network members they select and the extent to which the characteristics of these alters meet their preferences, are constrained by the available pool of potential associates in these contexts. By examining social distance and shared social contexts simultaneously, we can determine whether these two conditions coincide or which of these conditions is most important. We therefore hypothesize that the effect of social distance on triadic closure decreases if two alters share or shared one or more social contexts (H6).

With regard to the effect of the ethnic composition of social contexts on inter- or intra-ethnic relationships, Park (1952:177) stated that “residential proximity of persons belonging to the same ethnic group and the existence of ethnic institutions in a district together increase the tendency to intra-ethnic interactions” (cf. Huckfeldt 1983). Moreover, according to Esser (1986), “spatial segregation forms the basis for the establishment of ethnic institutions.” Unfortunately, we do not know the actual

² Notwithstanding this, we still argue and expect that triadic closure is more likely if alters have a *previously shared context* than if they have not.

social composition, and therefore also not the actual ethnic composition of all the specific social contexts in which the respondents are embedded. Nonetheless, if we find that the effect of national origin similarity on triadic closure decreases after including the sharing of social contexts, we can assume that this is – at least partly – because people disproportionately meet others with the same national origin in the social contexts they enter into in their daily lives. In short, we hypothesize that the effect of national origin similarity on triadic closure decreases if two alters share or shared one or more social contexts (H7).

Data And Methods

The Sample

We use data from the Swedish survey titled *Social Capital and Labor Market Integration: A Cohort Study*. For this survey, a sample of 5,836 individuals was selected for a telephone interview by Statistics Sweden between October 2009 and January 2010 (Edling and Rydgren 2010). This sample consists of three different groups of Swedes who were all born in 1990: a) all individuals with at least one parent born in Iran; b) 50 percent of all individuals with at least one parent born in former Yugoslavia; and c) a random sample of individuals whose parents were both born in Sweden. With response rates of 47.1% for Iranians, 46.6% for former Yugoslavs, and 55.3% for native Swedes, the number of respondents for each of these groups was: 632 first- and second-generation immigrants from Iran; 928 first- and second-generation immigrants from former Yugoslavia; and 1382 native Swedes.

The reason for specifically selecting individuals with an Iranian or former Yugoslavian background was to avoid the often problematic category of *immigrants*, which is too heterogeneous for many research objectives. In addition, this sampling procedure minimizes the problem of ending up with small numbers of respondents from specific countries of origin. Iran and former Yugoslavia are both major sources of migration to Sweden. Immigrants from Iran are primarily refugees and other humanitarian migrants. Former Yugoslavia has been the source of extensive labor immigration and more recently also of refugees.

Network delineation and dependent variable

The inner core of the respondents' networks have been delineated through the following name-generating

question: “*Who are the five persons whom you meet and hang around with most often in your leisure time?*” Next, name interpreting questions were asked with regard to alters' characteristics, characteristics of the relationship between ego and alter, and whether or not alters know each other.

In order to construct the dependent variable – triadic closure – all respondents with two or more alters were asked *whether or not each pair of their network members know each other* (with answer categories ‘yes’ and ‘no’), and subsequently – if answered in the affirmative – *how well these network members know each other* (with answer categories *not so well*, *fairly well*, and *very well*). As a logical consequence of the content of the name-generating question used in this study, we may assume that respondents know their alters rather well. Accordingly, we speak of triadic closure, if two alters know each other fairly well, or very well (see also Mollenhorst et al. 2011). The outcome (or dependent) variable *triadic closure* therefore is a dichotomous variable, coded ‘1’ if the respondent's two core network members (i.e., alters) know each other fairly well or very well, and ‘0’ if they do not.

Independent variables

Independent variables in this study appear at three different levels: (a) the individual level of the respondent – also referred to as *ego* or *focal actor*; (b) the dyadic *alter-alter* level, that is, similarity or other characteristics of the relationship between two of one's alters; and (c) the *triadic* level, that is, cross-level interactions between individual level and dyadic level covariates. Regarding the individual level, respondents were asked about a number of sociodemographic characteristics, which we use as control variables and/or to construct triadic level covariates: respondents' sex, level of education, religious background, (parental) national origin, and whether or not they have a girlfriend or boyfriend. Descriptive information on these respondent characteristics and network size are presented in Table 1.

At the dyadic and triadic level, we look at social distance, meeting opportunities, and national origin similarity between ego and alter and between two alters. Social distance is measured using four similarity measures on age, sex, level of education, and religion. Similarity with regard to sex, education (based on four categories: *lower secondary education*, *vocational education*, *gymnasium*, and *tertiary education*), and religion (based on four categories: *not religious*, *Christian*, *Muslim*, and *other religion*) is measured using dichotomous variables,

Table 1. Ego / Network characteristics (N=2942)

	Percentage	Number of non-missing cases (individuals)
Sex (0=male; 1=female)	49.22	2,942
Highest level of education entered		2,890
No secondary education	6.33	
Currently in secondary education	22.01	
Finished only secondary education	45.26	
Currently at university (college/folkhogskola)	24.84	
Currently following other type of study	1.56	
Religious background		2,875
Not religious	54.57	
Christian	27.06	
Muslim	16.24	
Other religion	2.12	
National origin (= sample stratum)		2,942
Sweden	46.97	
Former Yugoslavia	31.54	
Iran	21.48	
Having a girl- or boyfriend		2,933
No romantic partner	66.14	
Has girl- or boyfriend	33.00	
Married	0.85	
Network size		2,942
0	1.77	
1	2.28	
2	7.00	
3	19.31	
4	16.52	
5	53.13	

Source: *Social Capital and Labor Market Integration: A Cohort Study, 2009/2010.*

coded '1' if they are similar and '0' if they are not.³ Age similarity is measured using a dichotomous variable, coded '1' if the age difference is three years or less and '0' if the age difference is more than three years.

National origin similarity is based on alter's country of origin. For each alter, we first asked whether he/she was born in Sweden. If the answer was in the negative, we asked for the specific country in which he/she was born. Even though the alters of the respondents were born in quite a few different countries (with small numbers per country) – See Appendix A for the list of countries – still about 78 percent of all alter-alter pairs were born in the same country. Because this research also focuses on the effects of (parental) national origin similarity in relationships between respondents and their alters as well as in (potential) relationships among respondents' alters, it is important that the measure that is used for the national origin of the respondent

(or focal actor) be as similar as possible to the measure that is used for the national origin of their alters. As mentioned in the previous section, this sample consists of three groups with different national origins: a) Iranian immigrants with at least one parent born in Iran; b) Yugoslavian immigrants with at least one parent born in former Yugoslavia; and c) native Swedes whose parents were both born in Sweden. We therefore recoded the variable for the national origin of one's alter by placing Bosnia, Croatia, Kosovo, Macedonia, Montenegro, Serbia, and Slovenia into one category labeled *Former Yugoslavia*, and by placing Arabic Country, Armenia, Assyria, Azerbaijan, Iraq, Iran, Syria, and Turkey into one category labeled *Middle East*. All other countries – except Sweden – are placed into one category labeled *Other*.⁴ Based on this variable for the national origin of alters, we find that about 80 percent of all alter-alter pairs are of the same national origin. We use this variable

³ Alters who both have an 'other religious background' are considered as having a dissimilar religious background.

⁴ Alters who are both of an 'other' national origin are considered as being of a dissimilar national origin.

as the indicator for alter's national origin in the final multivariate analyses.⁵

Meeting opportunities are measured by the number and the specific types of social contexts an ego previously shared and/or currently shares with each alter involved in the triad. To determine which social contexts are shared, respondents were asked (a) whether alter lives in the same residential area as ego, (b) whether they are or were in the same school as ego, (c) whether they are or were in the same school class as ego, (d) whether they are or were members of the same organization/club as ego, (e) whether they are or were connected with ego on an Internet community, and (f) whether they are or were workmates. In addition, we asked, *Where do you meet up most of the time*. From the answers to this question, we inferred (g) whether ego currently meets an alter at home, and (h) whether ego currently meets an alter while socializing.

We use the above information on sociodemographic characteristics (or social distance), meeting opportunities, and (parental) national origin similarity as the individual level, dyadic level, and triadic level variables. For example, at the individual level, the variable *proportion same age* indicates the proportion of alters whose age difference with the respondent is three years at max, while the variable *proportion same sex* indicates the proportion of alters who are of the same sex as the respondent. At the dyadic level, the variable *alter-alter same sex* indicates whether or not both alters are of the same sex. At the triadic level, we test for interaction effects between individual (respondent) level characteristics and dyadic level characteristics. For example, the variable *triad same sex* indicates whether or not ego and both alters are of the same sex; *ego-alter same sex* indicates that one alter is of the same sex as the respondent (while the other is not); and *triad female* indicates that ego and both alters are all female. Similarly, the variable *ego currently shares the neighborhood with only 1 alter* indicates that one alter lives in the same neighborhood as the respondent (while the other does not); the variable *both alters currently share the neighborhood with ego* indicates whether or not both alters live in the same neighborhood as the respondent; and the variable *both alters previously shared workplace with ego* indicates whether or not both alters once met the respondent at work.

⁵ The operationalization of the variable for the national origin of the alters is indeed different from the operationalization of the variable for the (parental) national origin of the ego (i.e., the respondent / focal actor). For the egos, we do consider second generation immigrants as being immigrants, whereas – due to data limitations – for the alters, we only consider first generation immigrants as being immigrants. As a consequence, we assume that the effects of national origin similarity on triadic closure will be underestimated.

Three-level multiple membership logistic regression modeling

The data structure exhibits a multilevel dependence with alters nested in egos. The outcome (or dependent) variable in this study is the occurrence of *triadic closure*, that is, whether or not two core network members (alters) of the respondent (ego) mutually know each other fairly well or very well. This binary outcome variable refers to two alters (belonging to the same ego). Therefore, a three-level multiple-membership logistic regression model is used for the statistical analysis, with the occurrence of triadic closure belonging to two – equally important – alters who in turn are nested hierarchically within egos.

Our model formulation is different from the two-level model used for the analysis of personal networks with alters nested in egos (see, e.g., Van Duijn, Van Busschbach and Snijders 1999, De Miguel Luken and Tranmer 2010). The three-level multiple membership model is also different from the multiple membership (multiple classification) model proposed by Tranmer, Steel and Browne (2014), who consider data where respondents belong to multiple small network structures (cliques). It also improves upon research by Mollenhorst et al. (2011, cf. Louch 2000), who specifically accounted for the involvement of a prominent alter in the network, for example, one's romantic partner or girl-/boyfriend, who is likely to know many of the other alters.⁶

The basic logistic regression model formula used for the analyses is

$$\text{logodds}(y_{i(jk)}) = \beta_0 + \beta_1 x_i + \beta_2 z_{i(jk)} + \beta_3 x_i z_{i(jk)} + u_i + v_{ij} + v_{ik}$$

where $y_{i(jk)}$ denotes the triadic closure between alters j and k of ego i ; x_i is an explanatory variable for ego i , for instance ego's sex or the proportion of same-sex alters in the network, $z_{i(jk)}$ is a dyadic explanatory variable for the pair of alters (j, k), for example, same gender, and $x_i z_{i(jk)}$ denotes the *cross-level* interaction (or triadic) effect of ego and dyadic alter characteristics, for instance same sex for ego i and pair of alters (j, k). The intercept β_0 and the explanatory variables with their regression parameters (here denoted by β_1 , β_2 , and β_3) form the so-called fixed

⁶ In the current research, we performed additional analyses (not presented), while also including a variable that accounts for the sequence in which the alters were mentioned during the interview. These analyses showed significant results for this sequence indicator (suggesting that those who are mentioned earlier are more important, such that their involvement in the triad leads to a higher likelihood of triadic closure), but did not significantly change the other findings as presented in Table 3.

part of the model. The *random* part is formed by an ego-specific term u_i , defined at the highest level (3), which is assumed to be normally distributed with mean 0 and variance σ_u^2 , and two random terms at level 2, for both alters in the triad, nested in ego i , v_{ij} and v_{ik} , assumed to be normally distributed with mean 0 and variance σ_v^2 . Thus, the total variance at the alter level is $4\sigma_v^2$. Note that in logistic regression no level 1 residual is specified, as the level variance is implied by the model.

The model is estimated using MLwiN 2.28, which allows the specification of a multiple-membership multilevel model and offers MCMC estimation. Model estimation was improved by employing hierarchical centering at level 3 and using orthogonal fixed effect vectors, as explained in Browne (2012). All models were run with a burn in of 20,000 and a main run of 50,000⁷. Four models were estimated. The first is a social distance model including sex, education, and religion. This model was built rather heuristically by in a first step selecting the ‘best’ ego, dyadic alter-alter, and cross-level triadic variables for sex, education and religion separately, in a second step combining the selected variables, and finally leaving out one by one the non-significant variables. For the second and third models, containing (parental) national origin similarity and social context effects respectively, only the first step was performed. The final model was found by performing the second and third steps described above, combining the effects selected in the first three models and leaving out non-significant effects. Model selection was aided by the DIC diagnostic (reported in Table 3), a measure based on the estimated log-likelihood values in the MCMC sample. Note that, just like the deviance, DIC is sensitive to sample size and therefore incomparable for models with different numbers of observations.

Results

As presented in Table 1, many of the 2,942 respondents named five core network members (alters), which is due to the formulation of the name-generating question in the survey: “Who are the five persons whom you meet and hang around with most often in your leisure time?” Only 11 percent named 2 alters or less. This resulted in an average core network size of 4.05 alters. Altogether, these core

networks contain 20,456 triads, that is, the total number of all unique pairs of two alters in a personal network. For all these triads, we examined whether these triads are closed or not, and how the likelihood for triadic closure is affected by national origin (dis-)similarity between one’s alters, by the social distance between one’s alters, and by the sharing of social contexts.

In Table 2, we present descriptive information about all triads. By separating closed and non-closed triads, this table also indicates the bivariate associations between various alter-alter characteristics and triadic closure. First, we see that about 61% of all network triads are closed triads, which means that in 61% of all instances, two of one’s alters also mutually know each other fairly well or very well. Second, in line with our hypotheses, these descriptive statistics indicate that in general, triadic closure is associated with a smaller social distance, national origin similarity, and the sharing of various social contexts.

In Table 3, we present the results of the three-level multiple membership logistic regression models on the effects of social distance, national origin similarity, and shared contexts on triadic closure in core networks. The first three models test hypotheses 1 through 5 empirically. The fourth *synthesis* model is used to test hypotheses 6 and 7. We discuss these different models in the next subsections.

Social distance

Various results in Model 1 of Table 3 provide support for Hypothesis 1; triadic closure in core networks is indeed more likely the smaller the social distance between two of one’s alters. The extent and the exact way in which social distance affects triadic closure, however, differs between the various indicators for social distance. Regarding age similarity, we find that only the proportion of alters with the same age as the focal actor (i.e., less than 3 years difference) is significantly and positively associated with triadic closure. Neither dyadic (alter-alter) age-similarity, nor triadic (ego-alter-alter) age-similarity is significantly associated with triadic closure.⁸

Regarding sex, we see that triadic closure is less likely for triads in core networks of women. The significant coefficients for *same sex* and *both female* together indicate that triadic closure is more likely between two male alters,

⁷ For the fixed parameters, typically an effective sample size (ESS) of approximately 1500 or more was obtained, whereas the ESS was smaller for the ego variance estimate (around 1000), and much smaller for the alter variance (approximately 250). Results for models with a longer run of 100,000 resulted in higher ESSs for all parameters but only led to small changes in the parameter estimates.

⁸ One reason for not finding substantial effects for age similarity on triadic closure may be that variation in age among core network members is rather low for young people around the age of 19, as they may predominantly have same-age friends.

Table 2. Association between triadic closure and dyadic (alter-alter) characteristics (N=20,456)

	Triadic closure ^a		
Dyadic (alter-alter) characteristics	No (38.99%)	Yes (61.01%)	Number of non-missing triads (19,928)
<i>Social distance</i>			
Same sex	71.43%	80.04%	19,926
Same age (≤3years difference)	91.71%	94.84%	19,910
Same education	63.77%	73.44%	19,439
Same religion	64.42%	70.17%	19,908
<i>National origin similarity</i>			
Same country of birth	76.53%	80.56%	19,427
Same national origin ^b	77.69%	81.64%	19,427
<i>Previously shared social contexts</i>			
Number of previously shared contexts	0.50 (SD = 0.76)	0.94 (SD = 0.91)	19,928
Both were schoolmates of ego	33.10%	55.35%	19,910
Both were classmates of ego	13.34%	25.52%	19,910
Both were club mates of ego	3.04%	9.77%	19,900
Both were web mates of ego	0.33%	0.47%	19,906
Both were workmates of ego	1.20%	3.18%	19,918
<i>Currently shared social contexts</i>			
Number of currently shared contexts	1.21 (SD = 0.75)	1.66 (SD = 0.87)	19,928
Both live in the same neighborhood as ego	9.68%	20.79%	19,917
Both are schoolmates of ego	3.10%	7.12%	19,910
Both are classmates of ego	1.00%	4.55%	19,910
Both are club mates of ego	1.24%	6.01%	19,900
Both are web mates of ego	72.99%	77.99%	19,906
Both are workmates of ego	0.48%	1.28%	19,918
Both are meeting ego at home	22.97%	33.77%	19,855
Both are meeting ego while socializing	10.00%	14.82%	19,855

Source: *Social Capital and Labor Market Integration: A Cohort Study, 2009/2010.*

Notes:

a) Triads are considered *closed triads* if two of one's alters know each other fairly well, or very well.

b) This variable is recoded from the variable *born in the same country*, by taking Bosnia, Croatia, Kosovo, Macedonia, Montenegro, Serbia, and Slovenia into one category *Former Yugoslavia*, and Arabic Country, Armenia, Assyria, Azerbaijan, Iraq, Iran, Syria, and Turkey into one category *Middle East*.

and even more likely if all three (i.e., ego-alter-alter) are men.

Regarding education, we see that triadic closure is more likely for those who have more alters who attend(ed) secondary school, but especially who have alters who attend(ed) an institution of higher education. In addition, at the dyadic level, we find that triadic closure is more likely the more similar the two alters are in terms of education. Triadic education similarity does not have an additional effect on triadic closure.

Finally, regarding religion, on the one hand, we find that the larger the proportion of Christians or Muslims in a core network the less likely the occurrence of closed triads.

On the other hand, we see that triadic closure is more likely if both alters have the same religious background, in particular if both alters are Muslim regardless of ego's religion. In addition, for Christian egos, triadic religious similarity is positively associated with triadic closure, whereas for Muslims and non-religious people, triadic religious similarity slightly reduces the positive effect of the accompanying dyadic religious similarity.

National origin similarity

Results in Model 2 of Table 3 provide support for Hypothesis 2; national origin similarity in triads in

Table 3. Three-level multiple membership logistic regression models on triadic closure^a

	Model 1: Social distance	Model 2: National origin similarity	Model 3: Social Contexts	Model 4: Synthesis
Fixed part:				
Constant	-2.112 (0.337)	0.513 (0.168)	0.157 (0.172)	-2.331 (0.443)
<u>Ego level (incl. aggregated network characteristics)</u>				
Age of respondent	<i>n.i.</i>			<i>n.i.</i>
Proportion same-age alters	1.839 (0.325)			1.156 (0.367)
Sex of respondent (0=male; 1=female)	-0.442 (0.124)			-0.469 (0.134)
Proportion same-sex alters	<i>n.i.</i>			<i>n.i.</i>
Highest level of education attended by respondent	<i>n.i.</i>			<i>n.i.</i>
Proportion of alters with specific level of education				
Primary education	ref.			ref.
Secondary vocational education	2.074 (0.713)			1.227 (0.796)
Upper secondary education	0.587 (0.174)			0.623 (0.199)
Higher education	2.317 (0.631)			3.003 (0.705)
Religion of respondent				
Not religious	ref.			ref.
Christian	-0.096 (0.141)			-0.113 (0.158)
Muslim	0.251 (0.176)			0.387 (0.204)
Other religion	-0.501 (0.318)			-0.605 (0.350)
Proportions of alters with religion				
No religion	ref.			ref.
Christian	-0.419 (0.213)			-0.349 (0.240)
Muslim	-0.752 (0.311)			-0.798 (0.361)
Other religion	0.653 (0.551)			0.448 (0.625)
National origin of respondent (= sample stratum)				
Sweden		ref.		ref.
Former Yugoslavia		0.247 (0.194)		0.246 (0.238)
Iran		-0.126 (0.206)		0.182 (0.241)
Proportion same national origin		<i>n.i.</i>		<i>n.i.</i>
<u>Dyadic (alter-alter) level</u>				
Social distance				
Similar age	<i>n.i.</i>			<i>n.i.</i>
Same sex	0.544 (0.144)			0.605 (0.103)
Both Female	-0.591 (0.120)			-0.580 (0.134)
Similar education	0.615 (0.061)			0.398 (0.070)
Same religion	0.369 (0.115)			0.195 (0.131)
Both Christian	0.185 (0.207)			0.265 (0.241)
Both Muslim	1.332 (0.362)			1.237 (0.407)
Both other religion	0.292 (0.504)			0.707 (0.605)
Same national origin		0.341 (0.094)		0.121 (0.115)
<u>Triadic (ego-alter-alter) cross-level interactions</u>				
Social distance				
Triad same age	<i>n.i.</i>			<i>n.i.</i>
Triad same sex	0.484 (0.150)			<i>n.i.</i>
Triad similar education	<i>n.i.</i>			<i>n.i.</i>
Triad same religion	-0.297 (0.141)			-0.178 (0.160)
Christian x Triad same religion	0.842 (0.275)			0.724 (0.317)
Islam x Triad same religion	-0.063 (0.419)			-0.262 (0.473)
Other religion x Triad same religion	0.193 (1.350)			0.229 (1.585)
Same national origin				
Triad same national origin		0.182 (0.188)		0.231 (0.222)
Yugoslavia x Triad same national origin		0.582 (0.251)		0.676 (0.299)
Middle East x Triad same national origin		1.416 (0.396)		1.121 (0.460)

(continued on next page)

	Model 1: Social distance	Model 2: National origin similarity	Model 3: Social Contexts	Model 4: Synthesis
Meeting opportunities / Shared contexts				
Ego previously shared with only 1 alter:				
School			<i>n.i.</i>	<i>n.i.</i>
School class			-0.682 (0.072)	-0.631 (0.077)
Club / association			<i>n.i.</i>	<i>n.i.</i>
Internet			<i>n.i.</i>	<i>n.i.</i>
Work place			<i>n.i.</i>	<i>n.i.</i>
Ego currently shares with only 1 alter:				
School			0.314 (0.144)	0.301 (0.152)
School class			-1.768 (0.155)	-1.610 (0.166)
Club / association			<i>n.i.</i>	<i>n.i.</i>
Internet			-0.529 (0.141)	-0.538 (0.154)
Work place			-0.337 (0.124)	-0.359 (0.131)
Neighborhood			-0.154 (0.068)	-0.211 (0.072)
At home			-0.222 (0.090)	<i>n.i.</i>
Public going-out place			-0.336 (0.092)	-0.282 (0.096)
Both alters previously shared with ego:				
School			1.081 (0.145)	1.049 (0.158)
School class			0.471 (0.127)	0.559 (0.134)
Club / association			1.640 (0.139)	1.553 (0.146)
Internet			<i>n.i.</i>	<i>n.i.</i>
Work place			1.544 (0.222)	1.525 (0.236)
Both alters currently share with ego:				
School			2.297 (0.257)	2.381 (0.271)
School class			1.340 (0.316)	1.684 (0.338)
Club / association			2.793 (0.214)	2.528 (0.221)
Internet			-0.044 (0.151)	0.037 (0.162)
Work place			1.895 (0.361)	1.933 (0.377)
Neighborhood			1.598 (0.183)	1.462 (0.198)
At home			1.057 (0.129)	1.250 (0.115)
Public going-out place			0.892 (0.131)	0.944 (0.123)
Context overlaps – both alters share(d) with ego:				
Previously school x Currently Internet			0.416 (0.151)	0.410 (0.161)
Previously class x Currently home			-0.479 (0.159)	-0.485 (0.165)
Currently neighborhood x Currently Internet			-0.615 (0.200)	-0.616 (0.218)
Random part:				
Respondent level: ego variance	2.277 (0.180)	2.640 (0.198)	2.689 (0.214)	2.491 (0.219)
Dyad level: alter variance	1.518 (0.123)	1.471 (0.123)	1.727 (0.144)	1.888 (0.166)
DIC:	19924,6	20456,36	18143,193	16880,868
# Egos (Respondents)	2661	2683	2693	2649
# Alters	11206	11288	11419	11028
# Triads	19302	19427	19815	18774

Source: *Social Capital and Labor Market Integration: A Cohort Study*, 2009/2010.

Coefficients present log odds, with standard errors in parentheses.

n.i. (not included) indicates that the variable was left out in the model selection process because it was not significant.

Note:

a) Triads are considered *closed triads* if two of one's alters know each other fairly well, or very well.

core networks is indeed positively related to triadic closure. First, at the dyadic level, we see that triads are more likely to be closed if both of one's alters are of the same national origin. In addition, we see that for immigrants, triadic national origin similarity is also

strongly and positively associated with triadic closure. In other words, triads in core networks of first- and second generation immigrants from Former Yugoslavia or from Iran are more likely to be closed triads if their alters also come from Former Yugoslavia or from a

country in the Middle East.⁹ A similar effect is not found for native Swedes, which means that for native Swedes, only the fact that their two alters have the same ethnic background increases the likelihood that a triad is closed, irrespective of whether these two alters are immigrants or also native Swedes.

Social contexts

Many of the results in Model 3 of Table 3 provide substantial support for Hypotheses 3, 4, and 5; triadic closure in core networks is more likely if the focal actor previously met and/or even more so if the focal actor currently meets both alters in the same social context(s). The extent and the exact way in which shared social contexts are associated with triadic closure, however, differs between the various social contexts.

In general, the sharing of most of the social contexts with only one alter (i.e., not also with the other) is negatively associated with triadic closure. Note, however, that there is one exception to this: currently meeting one alter (and not also the other) at school is positively associated with triadic closure. The sharing of the same social context(s) with both alters, however, is strongly and substantially associated with triadic closure. This applies to both previously shared contexts as well as currently shared social contexts, although in line with Hypothesis 5, the coefficients for currently shared contexts are larger. Additional models, not presented, indicate that in line with Hypothesis 4, the more social contexts are shared by two alters, the more likely triads will be closed. Models 3 and 4 in Table 3, however, explain more of the variation than if we only include the number of shared contexts. That is, the sharing of each specific social context adds to the likelihood that triads are closed, although not equally for all contexts. We therefore present and discuss these findings in more detail.

We find the strongest context effects for the sharing of a school, a club or association, and for sharing a work place. That is, triadic closure is very likely if both alters were, and in particular if they currently are in the same school as the focal actor (and even more so if they are also in the same school class), if they were, and even more so if they currently are both members of the same club or association as the focal actor, and/or if they were, or

if they currently are both workmates of the focal actor. We also find substantial context effects for the sharing of the neighborhood, private homes, and public places for socializing. It is noteworthy that the sharing on the Internet is not significantly associated with triadic closure. In other words, being connected online with both alters does not affect the likelihood that they know each other (fairly or very) well over and above the sharing of other physical meeting contexts. However, the positive interaction effect for *previously school x currently Internet* indicates that the association between being former schoolmates and triadic closure is stronger for those who currently keep in touch via Internet.

The strong associations between the sharing of a school (class) and triadic closure and between the sharing of the work place and triadic closure support the argument that the more constraining the contexts are in which both alters meet, the more likely the occurrence of closed triads. Many of the young respondents in this research spend a great part of their time at school and in particular in their school class, while the other respondents did so rather recently. In addition, interactions among classmates are often strengthened because students have to do assignments in subgroups. Likewise, respondents who are no longer at school spend a great part of their time at work, and interactions among colleagues are often institutionally organized according to a division of labor and task specialization. In line with this constraints argument, contexts such as neighborhoods, public places for socialization, and a person's home, are relatively less likely to stimulate triadic closure. It is very possible that two persons who live in the same neighborhood know and get along with each other, but this is not necessarily the case. Interactions among neighbors are generally not enforced because there are no institutionalized rules for that, and it is seldom necessary to interact with neighbors at any price. And although meeting two alters at home increases the likelihood that they know each other, it is possible to invite these alters at different times, such that they will never meet each other.

Furthermore, we find that some combinations of shared contexts (see the interaction terms in Table 3, called *context overlaps*) reveal significant effects on triadic closure. First, as already mentioned, the positive interaction effect for *previously school x currently Internet* tells that if both alters previously attended the same school as ego, while currently are both connected online with ego, triadic closure is even more likely than if one previously shared only the school contexts or if one is only currently connected online with both alters. Second,

⁹ This may partly be a consequence of opportunity structure. As compared to native Swedes, the relatively small number of immigrants from Former Yugoslavia and Iran may increase the likelihood of network closure among people who are of the same (parental) national origin (cf. Blau 1994).

the negative interaction effect for *previously class x currently home* tells us that if both alters were previously in the same school class as ego, while both currently meet ego at home, the effects of previously sharing the school class on triadic closure vanishes. And third, the negative interaction effect for *currently neighborhood x currently Internet* tells that if both alters live in the same neighborhood as ego, while they are both currently also connected online with ego, the effects of currently sharing the neighborhood on triadic closure is smaller (note that the main effect of currently being connected online on triadic closure is insignificant).

Synthesis

Finally, we test to what extent the association between sociodemographic similarity and triadic closure, but in particular between national origin similarity and triadic closure, can be explained by the sharing of social contexts. That is, we test whether the effects of social distance (Hypothesis 6) and of national origin similarity (Hypothesis 7) on triadic closure decrease if two alters share one or more social contexts. To this end, we combined the variables that were significant in the first three models in Table 3 into one regression, after which we removed the covariates that were no longer significant. The remaining significant effects are presented in Model 4 in Table 3.

Several numbers in Model 4 in Table 3 provide support for Hypothesis 6. That is, at the individual level (including aggregated network characteristics), we see, for example, that the coefficients for the proportion same age alters in the network and for the proportion alters who attend(ed) secondary education (and not more) become smaller. At the dyadic (alter-alter) level, we see that the coefficient for education similarity becomes substantially smaller, and that the main effect of religious similarity on triadic closure becomes insignificant. And at the triadic (ego-alter-alter) level, we see that the coefficient for sex similarity becomes insignificant¹⁰ and that the coefficient for religious similarity becomes smaller for Christians. These findings support the argument that homogeneity in personal networks is partly a result of meeting similar others in social contexts that are disproportionately homogeneously composed.

¹⁰ This means that regarding sex similarity, there is no increased likelihood for same sex triadic closure, whereas triadic closure remains more likely between two male alters (regardless of ego's sex) and for male egos (compared to female egos with equal alter-alter sex composition), and controlling for similarity on other sociodemographic characteristics, national origin similarity, and shared social contexts.

Model 4 in Table 3 provides little support for Hypothesis 7. That is, only at the dyad (alter-alter) level do we see that the coefficient for national origin similarity is smaller and no longer significant. At the triad (ego-alter-alter) level, the coefficient for (parental) national origin similarity hardly changes after adding social contexts to the model. Only for immigrants from Iran does the coefficient for national origin similarity (i.e., all have their roots in the Middle East) become slightly smaller. This implies that, controlling for social distance and shared social contexts, triadic closure is only more likely in all-Yugoslavian triads or between Middle-Eastern alters of Iranian respondents, and not in all-Swedish triads or between national origin similar alters of Swedish respondents.¹¹ Furthermore, for almost all types of social contexts, we see that the coefficients for shared contexts remain practically unchanged after adding the variables on social distance and national origin similarity. Only the initially positive associations between meeting one alter (and not also the other) in the neighborhood and triadic closure and between meeting one alter (and not also the other) at home and triadic closure are no longer significant. All coefficients for sharing the same social contexts with both alters are insensitive to controlling for social distance and national origin similarity effects. Altogether, this indicates that the associations between (previously as well as currently) shared social contexts and triadic closure are very robust.¹²

Conclusions and Discussion

We examined the core networks of 2,942 individuals, who were all born in 1990 and living in Sweden in 2009. About 47 percent of these individuals have parents who were both born in Sweden, about 32 percent have at least one parent born in Sweden, about 32 percent have at least one parent born in Former Yugoslavia, and about 21 percent have at least one parent born in Iran. Specifically, we examined triadic closure in the core networks of the individuals and how closure is associated with social distance, national origin similarity, and the sharing of social contexts.

¹¹ This may partly be a consequence of the oversampling of immigrants in our survey.

¹² We performed additional analyses, not presented, in which we controlled for a) network size, b) whether the focal actor had a romantic relationship, and c) the consecutive number in which the alters involved were mentioned during the interview. Although all three indicators are significantly associated with triadic closure, controlling for their effects did not appreciably alter the coefficients as presented in Table 3.

Results from the three-level multiple membership logistic regression analyses provide support for most of our hypotheses by showing that all three structural conditions are significantly associated with triadic closure. A small social distance between two of one's alters, a similar national origin of these alters, and the sharing of social contexts with both alters increase the likelihood of triadic closure. Some of the coefficients for social distance and national origin similarity become smaller if we take shared contexts into account. This supports the notion that individuals find similar others in social contexts with a disproportionally homogeneous social composition. Out of these three conditions, the coefficients for the sharing of social contexts are the largest and robust¹³, strongly suggesting that meeting opportunities are a dominant condition for triadic closure.

Some interesting differences are found when comparing the findings in this paper on triadic closure in core networks of 19-year old native Swedes and immigrants living in Sweden, with findings on triadic closure in core discussion networks of a representative sample of 26 to 72-year old persons living in the Netherlands (see Mollenhorst et al. 2011). First, regarding social distance effects, Mollenhorst et al (2011) found a small negative association between age similarity and triadic closure and a substantial negative association between sex similarity and triadic closure. The Swedish data only show a more general, though positive association between the proportion of same age alters of ego and triadic closure. Regarding sex, in addition to a higher likelihood for triadic closure in core networks of men, the results indicate that triadic closure is more likely between two male alters (irrespective of the focal actor's sex). A plausible reason for these differences, we think, is the younger sample of respondents in the Swedish dataset as compared to the Dutch dataset. Young people may have a stronger preference for age- and sex-similar others than do older people (see, e.g., Feiring 1999). Moreover, the negative association between sex similarity and triadic closure as found in the Dutch study was largely explained by the involvement of the romantic partner in the triad. It may well be that this is less the case for the younger set of respondents in this study. In the Swedish dataset, only one third of the respondents mentioned having a girlfriend or boyfriend. Unfortunately, we have no indicator for whether

or not a specific alter is the respondent's girlfriend or boyfriend, such that we are unable to examine whether a similar process is taking place in the core networks of the Swedish adolescents. Additional analyses, not presented, in which we controlled for the consecutive number in which the alters involved were mentioned during the interview (assuming that a girlfriend or boyfriend – if present – will be mentioned first), however, did not appreciably alter the coefficients as presented in Table 3.

Second, regarding context effects, the Dutch and Swedish studies both show that the sharing of the focal actor's home, and even more so the sharing of the work place are strongly and positively associated with triadic closure. In addition, both studies show that the associations between shared contexts and triadic closure are substantially larger for currently shared contexts than for initially or previously shared contexts. This may be because each of these alters did not share this social context with ego at the same time and/or because these alters no longer share this context, such that they also no longer see and consequently do not really know each other anymore. In this paper, we find additional positive associations for, among other things, the sharing of the neighborhood, public places for socializing, clubs and associations, the school, and especially for the sharing of the school class. Sharing the internet context, i.e., being connected online with both alters, is not significantly associated with triadic closure, which may partly be because our young respondents have many online connections.¹⁴ Notwithstanding that, these findings altogether support the argument that opportunities to physically meeting each other are a very dominant condition for the emergence and composition of personal networks.

To extend the research on triadic closure in personal networks, we added the focus on national origin similarity in network triads. In more than three-quarters of all unique sets of two network members, both of one's alters are born in the same country. As a consequence of this opportunity structure, many closed triads also consist of two alters who are of the same national origin. On top of that, for first- and second-generation immigrants from Former Yugoslavia and Iran, we still find significant associations between a shared ethnic background and triadic closure, in particular at the triad level. That is, for these immigrants, triadic closure is more likely if the national origin of these alters is similar to their own or their parents' national origin of (see footnotes 5, 9 and 11).

¹³ Note that the variables for shared social contexts are inferred on the basis of ego-alter characteristics. It is possible, however, that two alters do share a specific social context with each other, but not with the focal actor. This implies that the effects of shared social contexts on triadic closure may be somewhat underestimated.

¹⁴ Table 3 indeed shows that three-quarters of all triads consist of alters who are both connected online with the focal actor.

While the triad-level (parental) national origin similarity coefficient for immigrants remains constant, the general effect of dyad-level national origin similarity on triadic closure (presented in Table 3, Model 2) disappears if we take shared contexts into account. The latter provides some support for the argument that (parental) national origin similarity in personal relationships is – at least to some extent – a result of meeting opportunities (cf. Park 1952, Huckfeldt 1983, Esser 1986).

Finally, now that we have examined some relevant conditions for triadic closure, what are the consequences of triadic closure remains an open question. And in particular, what are the consequences of closed triads that consist of alters who are of a different national origin. Closely related to this issue are questions regarding national origin (or ethnic) bridging or brokerage in personal networks. For example, an individual who has two native Swedish alters and three alters who are originally from Iran may strictly separate both parts of the network from each other. If this is the case, the focal actor plays a bridging or brokerage role in the network by establishing a (unique) link between both parts of the network, that is, between both nationalities / ethnic groups. Future research should examine what kinds of people tend to be brokers in this respect, and indicate the consequences of being in such a position in the network.

References

- Allport, G., 1954. *The Nature of Prejudice*. Cambridge, MA: Addison Wesley.
- Blau, P.M., 1977. *Inequality and Heterogeneity*. The Free Press, New York.
- Blau, P.M., 1994. *Structural Contexts of Opportunities*. The University of Chicago Press, Chicago.
- Blau, P.M., Schwartz, J.E., 1984. *Crosscutting Social Circles. Testing a Macrostructural Theory of Intergroup Relations*. Academic Press Inc., Orlando.
- Browne, W.J., 2012. MCMC estimation in MLwiN. Version 2.26. Centre for Multilevel Modeling, University of Bristol.
- Byrne, D., 1971. *The Attraction Paradigm*. New York: Academic.
- Chiswick, B.R., Miller, P.W., 2001. A model of destination-language acquisition: Application to male immigrants in Canada. *Demography* 38, 391-409.
- De Miguel Luken, V., Tranmer, M., 2010. Personal support networks of immigrants to Spain: A multilevel analysis. *Social Networks* 32, 253-262.
- Edling, C., Rydgren, J., 2010. *Social Capital and Labor Market Integration: A Cohort Study - Data and Codebook*. Stockholm University, Stockholm.
- Espinosa, K.E., Massey, D.S., 1997. Determinants of English proficiency among Mexican migrants to the United States. *International Migration Review* 31, 28-50.
- Esser, H., 1986. Social Context and Inter-ethnic Relations: The Case of Migrant Workers in West German Urban Areas. *European Sociological Review* 2, 30-51.
- Fararo, T.J., Skvoretz, J., 1987. *Unification Research Programs: Integrating Two Structural Theories*. *American Journal of Sociology* 92, 1183-1209.
- Feiring, C., 1999. Other-Sex Friendship Networks and the Development of Romantic Relationships in Adolescence. *Journal of Youth and Adolescence* 28, 495-512.
- Feld, S.L., 1981. The Focused Organization of Social Ties. *American Journal of Sociology* 86, 1015-1035.
- Fischer, C.S., 1982. *To Dwell Among Friends: Personal Networks in Town and City*. University of Chicago Press, Chicago.
- Fischer, C.S., Jackson, R.M., Stueve, C.A., Gerson, K., McCallister Jones, L., Baldassare, M. (Eds.), 1977. *Networks and Places. Social Relations in the Urban Setting*. Free Press, New York.
- Heider, F., 1985. *The Psychology of Interpersonal Relations*. John Wiley and Sons Inc., New York.
- Holland, P.W., Leinhardt, S., 1970. A Method for Detecting Structure in Sociometric Data. *American Journal of Sociology* 76, 492-513.
- Huckfeldt, R.R., 1983. Social Contexts, Social Networks, and Urban Neighborhoods: Environmental Constraints on Friendship Choice. *American Journal of Sociology* 89, 651-669.
- Kalmijn, M., 1998. Inter marriage and Homogamy: Causes, Patterns, Trends. *Annual Review of Sociology* 24, 395-421.
- Kalmijn, M., Flap, H., 2001. Assortative Meeting and Mating: Unintended Consequences of Organized Settings for Partner Choices. *Social Forces* 79, 1289-1312.
- Kanas, A., Van Tubergen, F., 2009. The impact of origin and host country schooling on the economic performance of immigrants. *Social Forces* 88, 893-916.
- Krackhardt, D., Kilduff, M., 1999. Whether Close or Far: Social Distance Effects on Perceived Balance in Friendship Networks. *Journal of Personality and Social Psychology* 76, 770-782.
- Lazarsfeld, P.F., Merton, R.K., 1954. *Friendship as Social Process: A Substantive and Methodological Analysis*. In: Berger, M., Abel, T., Page, C.H. (Eds.), *Freedom and Control in Modern Society*. Van Nostrand, New York, pp. 18-66.
- Louch, H., 2000. Personal Network Integration: Transitivity and Homophily in Strong-Tie Relations. *Social Networks* 22, 45-64.
- Marsden, P.V., 1990. Network Diversity, Substructures, and Opportunities for Contact. In: Calhoun, C., Meyer, M.W., Scott, W.R. (Eds.), *Structures of Power and Constraint. Papers in Honor of Peter M. Blau*. Cambridge University Press, New York, pp. 397-410.
- McPherson, M., Smith-Lovin, L., Cook, J.M., 2001. Birds of a Feather: Homophily in Social Networks. *Annual Review of Sociology* 27, 415-444.
- Mollenhorst, G., Volker, B., Flap, H., 2008a. Social Contexts and Core Discussion Networks. Using a Choice-Constraint Approach to Study Similarity in Intimate Personal Relationships. *Social Forces* 86, 937-965.
- Mollenhorst, G., Volker, B., Flap, H., 2008b. Social Contexts and Personal Relationships: The Effect of Meeting Opportunities on Similarity for Relationships of Different Strength. *Social Networks* 30, 60-68.
- Mollenhorst, G., Volker, B., Flap, H., 2011. Shared Contexts and Triadic Closure in Core Discussion Networks. *Social Networks* 33, 292-302.

- Mollenhorst, G., Volker, B., Flap, H., 2014. Changes in Personal Relationships: How Social Contexts Affect the Emergence and Discontinuation of Relationships. *Social Networks* 37, 65-88.
- Park, R.E., 1952. *Human Communities: The City and Human Ecology*. The Free Press, Glencoe, Illinois.
- Pettigrew, T.F., 1975. The Racial Integration of the Schools. In: Pettigrew, T.F. (Ed.), *Racial Discrimination in the United States*. New York: Harper & Row, pp. 224-239.
- Pettigrew, T.F., 1986. The contact hypothesis revisited. In: Hewstone M., Brown R., (Eds.) *Contact and Conflict in Intergroup Encounters*. Oxford: Blackwell, pp. 169-195.
- Pettigrew, T.F., 1998. Intergroup contact theory. *Annual Review of Psychology* 49, 65-85.
- Rydgren, J., Sofi, D., 2011. Interethnic Relations in Northern Iraq: Brokerage, Social Capital and the Potential for Reconciliation. *International Sociology* 26, 25-49.
- Simmel, G., 1955. *Conflict and The Web of Group Affiliations*. Free Press, New York (first published in English in 1922).
- Tajfel, H., Turner, J.C., 1979. An integrative theory of intergroup conflict. In: Austin, W.G., Worchel, S. (Eds.), *The social psychology of intergroup relations*. Monterey, CA: Brooks/Cole, pp. 33-47.
- Tranmer, M., Steel, D., Browne, W.J., 2014. Multiple-membership multiple-classification models for social network and group dependencies. *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 177 (2), 439-455.
- Van Duijn, M.A.J., Van Busschbach, J.T., Snijders, T.A.B., 1999. Multilevel Analysis of Personal Networks as Dependent Variables. *Social Networks* 21, 187-209.
- Verbrugge, L.M., 1977. The Structure of Adult Friendship Choices. *Social Forces* 56, 576-597.
- Wasserman, S., Faust, K., 1994. *Social Network Analysis. Methods and Applications*. Cambridge University Press, New York.

Appendix: Country of birth of alters

Country of birth	Freq.	Perc.	Country of birth	Freq.	Perc.	Country of birth	Freq.	Perc.
Missing	213	1.78	England	13	0.11	Nigeria	1	0.01
Abidjan	1	0.01	Eritrea	11	0.09	Norway	18	0.15
Afghanistan	18	0.15	Estonia	1	0.01	Pakistan	4	0.03
Africa	5	0.04	Ethiopia	6	0.05	Palestine	10	0.08
Albania	19	0.16	Finland	26	0.22	Peru	7	0.06
Algeria	5	0.04	Former Yugoslavia	7	0.06	Philippines	4	0.03
Angola	1	0.01	France	3	0.03	Poland	24	0.20
Arabic Country	2	0.02	Gambia	2	0.02	Portugal	2	0.02
Argentina	3	0.03	Georgia	1	0.01	Romania	11	0.09
Armenia	4	0.03	Germany	15	0.13	Russia	24	0.20
Asia	1	0.01	Ghana	3	0.03	Rwanda	2	0.02
Assyria	1	0.01	Greece	7	0.06	Saudi Arabia	2	0.02
Australia	5	0.04	Guatemala	1	0.01	Senegal	2	0.02
Austria	2	0.02	Hungary	5	0.04	Serbia	86	0.72
Azerbaijan	4	0.03	India	11	0.09	Slovenia	2	0.02
Bangladesh	6	0.05	Indonesia	1	0.01	Somalia	18	0.15
Belarus	2	0.02	Iraq	110	0.92	South America	1	0.01
Belgium	5	0.04	Iran	163	1.36	South Korea	1	0.01
Bolivia	4	0.03	Ireland	2	0.02	Spain	8	0.07
Bosnia	435	3.64	Israel	2	0.02	Sri Lanka	8	0.07
Brasil	7	0.06	Italy	8	0.07	Sweden	9,833	82.30
Bulgaria	4	0.03	Jordan	2	0.02	Syria	16	0.13
Burundi	1	0.01	Kenya	1	0.01	Tanzania	2	0.02
Cameroon	1	0.01	Korea	7	0.06	Thailand	7	0.06
Canada	4	0.03	Kosovo	292	2.44	The Netherlands	5	0.04
Central America	1	0.01	Kurdistan	89	0.74	Tunisia	3	0.03
Chile	23	0.19	Kuwait	2	0.02	Turkey	27	0.23
China	8	0.07	Kyrgyzstan	1	0.01	Turkmenistan	2	0.02
Colombia	20	0.17	Latvia	3	0.03	Uganda	5	0.04
Congo	2	0.02	Lebanon	24	0.20	Ukraine	6	0.05
Cote d'Ivoire	1	0.01	Liberia	1	0.01	Uruguay	1	0.01
Croatia	60	0.50	Libya	1	0.01	USA	20	0.17
Cuba	1	0.01	Macedonia	14	0.12	Uzbekistan	3	0.03
Czech Republic	2	0.02	Malaysia	1	0.01	Venezuela	1	0.01
Denmark	19	0.16	Mexico	2	0.02	Vietnam	9	0.08
Dubai	2	0.02	Mongolia	1	0.01	West India	1	0.01
Ecuador	3	0.03	Montenegro	27	0.23	<u>Yemen</u>	<u>3</u>	<u>0.03</u>
Egypt	3	0.03	Morocco	2	0.02	Total	11,948	100.00
El Salvador	1	0.01	Mozambique	2	0.02			